Processing of grapes by high hydrostatic pressure. Influence on wine quality.

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Introduction

High hydrostatic pressure (HHP) is a cold technology allowing the control of microorganisms at low temperature (room temperature or refrigeration).

Frequently yeast and non sporogenic bacteria can be controlled using pressures of 400-600 MPa during 3-10 min [1]. The low temperature allows HHP to pasteurize fruits, vegetables and other foods with low repercussion in sensorial properties. Moreover, the energy of HHP treatment is not enough to break covalent bonds, therefore molecules with sensorial repercussion such us pigments or aromatic compounds remain unaffected when food is pressurized [2].

Grapes and must are not cleaned or sanitized in wine industry except by the application of SO_2. The use of HHP improves the sanitary conditions of the grape allowing the reduction of SO2 levels, moreover facilitate the use of emerging biotechnologies such us the use of mixed or sequential fermentations with non-*Saccharomyces* [3]. HHP can be used as well for cold pasteurization of wines with lower effects on sensorial quality than other conventional technologies [4].

Furthermore, HHP technology can be used to increase the extraction of phenolic compounds from grapes [3] and grape by-products [5] affecting and improving wine quality and facilitating the technological processing of grape pomace.

The aim of this work has been to analyze the effect of HHP process on microbial populations in grapes and also the repercussion on wine quality.

Results and Discussion

HHP treatments are very gentle with food and after processing the morphology and external structure of grape berries remain similar to controls (Figure 1).

Although external appearance is not affected some effects are produced in cell wall structure of grapes because when grapes are crushed a higher color and phenol extraction is observed in must from pressurized grapes with regarding to controls (Figure 2). Therefore, HHP treatments can be used to facilitate the extraction of phenolic compounds and the acceleration of wine maceration.

After fermentation the content of total anthocyanins was higher in all the pressurized samples than in the controls. Similar trend shows the total polyphenol index. Despite this higher phenol extraction, when the wines were evaluated by a sensory panel, HHP processed grapes were not perceived more astringent or bitter than control wines. Consequently, HHP processing of grapes is a selective way to increase the extraction of pigments and tannins without increasing negative sensations such as astringency or vegetal notes.

Microbial counts showed a positive effect of HHP treatments with the total elimination of the wild yeasts at pressure level of 400 MPa or higher (Figure 3). Treatments at 200 MPa produced the reduction of the initial counts in 1 log. HHP was not able to control bacteria populations at whatever pressure level (200-550 MPa), however, the initial population was reduced at least 1 log.

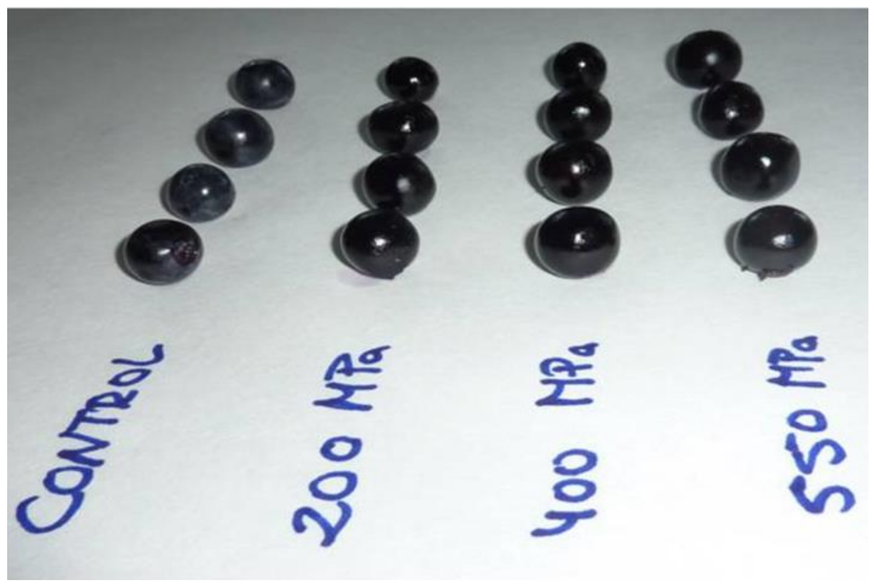

Figure 1. Berry appearance in controls and after pressurization at 200, 400 and 550 MPa (1MPa = 10 bar).

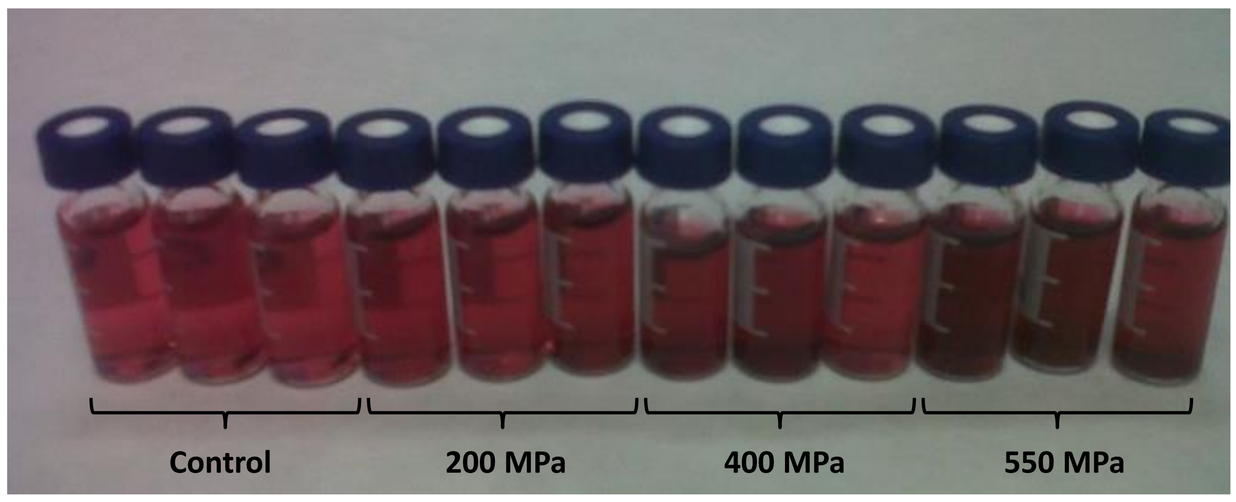

Figure 2. Must extracts after HHP processing and crushing before fermentation. Each vial was taken from an independent sample. Extracts were filtered at 0.45 µm to remove colloidal particles.

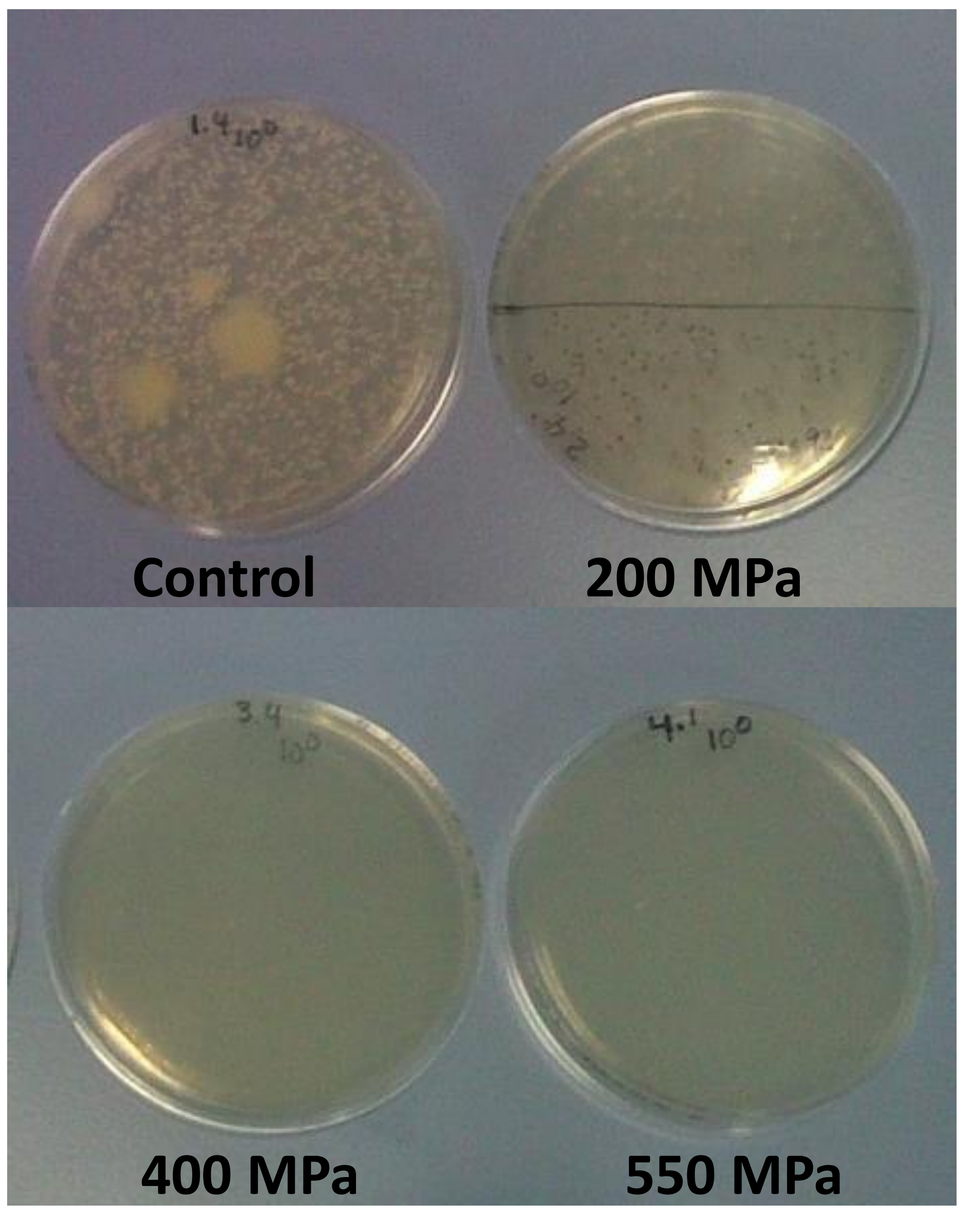

Figure 3. Petri dishes in GCA medium showing the wild yeast population of grapes in the control and HHP treatments.

Conclusions

HHP enhances the extraction of phenolic compounds increasing the content of pigments and tannins. **Wild yeast populations of grapes can be removed by HHP** at 400 MPa and bacteria populations can be reduced. The use of pressurization improves microbiological quality of grapes allowing the reduction of SO_2 levels, the implantation of selected starters and the use of emerging biotechnologies such us the fermentation with non-*Saccharomyces* or the co-inoculations yeast-LAB.

Materials and Methods

Vitis vinifera L. grapes (variety Tempranillo) were manually destemmed and vacuum packed in bags. Pressure treatments were performed using a pilot-scale HHP device (Stansted Fluid Power Ltd., Harlow, Exxes, UK). Water was used as the compressing fluid. Treatments were performed at 200, 400 and 550 MPa for 10 min.

After pressurization, grapes were placed in sterilized 500 ml flasks. They were crushed, and the must inoculated with commercial yeast CEG (Lallemand, Montreal, Canada) and fermented isothermally in the absence of SO_2.

Microbiological counts were performed on grapes following the HHP procedure and on wines at the end of fermentation using GCA (glucose chloramphenicol agar), PCA supplemented with nystatin and MRS agar supplemented with nystatin.

Anthocyanins were analyzed by HPLC-DAD-ESI/MS, volatile compounds were analyzed by GC-FID, metabolites by enzymatic test and sensory evaluation using a trained taste panel, all according to [3].

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